World Congress on Water, Climate and Energy

Supplemental irrigation in farming systems: history of a practice and outlooks for Burkina Faso.

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Introduction

Agriculture is the main economic activity of Sahelian countries. In Burkina Faso, agriculture occupies 80% of the population, but nearly 49% of rural families are unable to produce or acquire sufficient food to meet their needs (FAO, 2011). Mainly rainfed, it is highly dependent on climatic conditions (figure1) and is therefore particularly vulnerable to climate change (figure 2).

To cope with this decline in rainfall, farmers have used traditional techniques and technologies developed by agricultural research centers.

These techniques include techniques for collecting runoff such as Zaï and half-moon that concentrate water at the foot of the culture or the use of short cycle varieties that allows accommodating a shorter rainy season.

In addition to these techniques, other forms of adaptation have been developed with the support of governments and donors for construction of large dams and small dams and irrigation schemes. Supplemental irrigation consists in providing the dose to plant during dry spells of the rainy season, reduces water stress and improves yields, but the practice is not widespread in the Sahelian zone. This study is a synthesis of the history of supplemental irrigation in developing countries and an analysis of different management methods in Burkina Faso.

Methods

Work consists of a literature review on the practice of supplemental irrigation on farms and the experiences of Burkina Faso, depending on the mobilization of water, cultivated land development and speculation.

The supplemental irrigation occurs during the rainy season during dry spells (figure 3) to prevent crops from suffering water stress. The characterization of dry sequences is described by Sané et al (2008). The aim is to bring water to crops at the time that crops need water.

The implementation of the practice (figure 4) differs depending on the size of the plot, the available water resources, the technical and financial (Dugue, 1986; Grewal et al, 1989; Dembélé et al, 1999; Fox, 2003; Somé and Ouattara, 2005; Narayan et al, 2008; CNID-B, 2009)

The agronomic potential is evaluated and financial analyzes are made for an area of one hectare of a given speculation, according to water resources, arrangement of plots and irrigation technology.

Results

Although little known and little practiced by farmers, supplemental irrigation is not such a new practice in Burkina Faso. Several research projects have been carried out in the country (Table I). It is practiced in Burkina Faso for over twenty years, but the results of various projects remain mixed.

Studies show that the practice is profitable (Fox, 2003; Panigrahi et al, 2007), but Kumar and van Dam(2008) argue that with high capital cost of water harvesting systems needed for supplemental irrigation, the small and marginal farmers would have less incentive to go for it.

For rice cultivation on sandy soil in south-western Burkina Faso, the results show that supplemental irrigation maintains acceptable performance, but the difference in yield compared with rice grown in strictly rainfed agriculture is not significant. Then, supplemental irrigation is necessary for years of poor rainfall (Dembélé et al, 1999). The gain in yield due to supplemental irrigation in the Sahel region is 6 quintals per hectare (more than 40% of yield) if you work the ground and only 1 quintal per hectare with direct seeding without tillage (Dugué, 1986). In his study on sorghum cultivation, Fox (2003) noticed that collection and storage of surface runoff for supplemental irrigation provided substantially improved yields 3-5 greater than farmers yields during experimental period in Tougou in Burkina Faso. Somé and Ouattara (2005) show that for the cultivation of sorghum in northern Sudanian zone, supplemental irrigation improves by about 30% harvest index in years of poor rainfall.

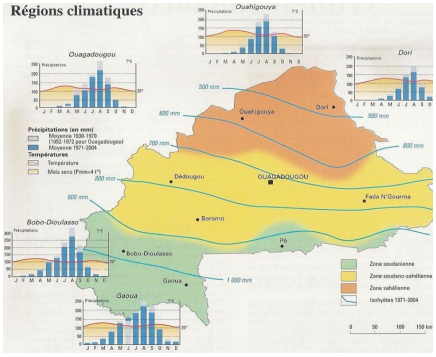

Figure 1: Climatic areas in Burkina Faso (*Atlas de l'Afrique – Burkina Faso, 2005*)

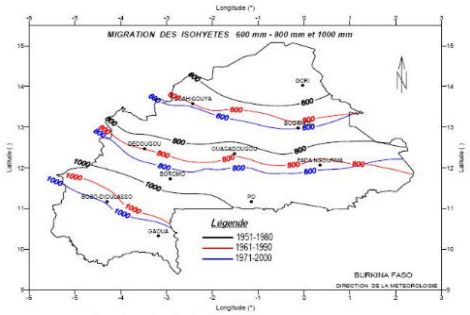

Figure 2: Displacement of isohyets in Burkina Faso (Groupe d'experts PANA du Burkina Faso, 2003)

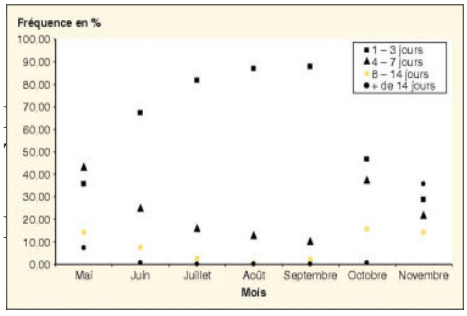

Figure 3: Dry spells in Upper Casamance from 1951 to 2000 (Sané et al, 2008)

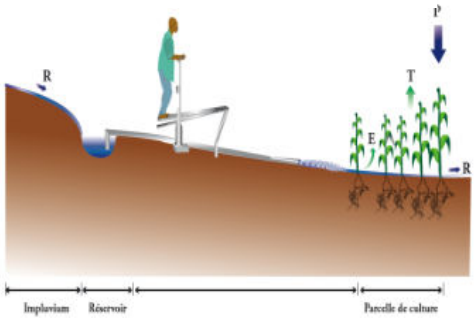

Figure 4: The implementation of supplemental irrigation based on Fox and Rockström work (2003)

Organisation	Author	Year	Place	Water mobilization	Water Resource	Crop	Vocation
CIRAD	DUGUE P.	1986	Sabouna	manual pumping and motorized pump	water harvesting tank	maize, sorghum, gombo, pea	Research and farmer support
INERA	Dembélé Y. et al	1999	Karfiguèla, Farako-Bâ	motorized pump	dam	rice	Research
University of Stockholm	FOX P.	2003	Tougou	foot pump	water harvesting tank	maise	Research
INERA	SOME L & OUATTARA K.	2005	Saria, Sabouna	sprinklers and motorized pump	wells with nozzle	sorghum	Research
NGO AZN/Terre Verte	NGO	2006	Guiè	foot pump	water harvesting tank	maize, pimento	Farmer support
CNID-B	CNID-B	2009	Sourou	Spray ramp	river Sourou	maize	Research

Table 1: Some experiences in Burkina Faso.

Discussion and Conclusions

Supplemental irrigation is not widespread in the in Burkina Faso. Though, this practice would support rainfed production and secure farmers' income. However, its implementation is not an easy task, especially in areas where morphopedological and economic conditions are unfavorable.

Several research projects have been led, but this practice is still not developed enough, because of the non-integration of a participative approach from the beginning to the end of these projects. So, farmers did not appropriate this innovative technic for producing better under climatic conditions with a drying trend.

Farmers and researchers must work together to jointly build a profitable and sustainable agricultural model based on the specificity of the Sahel. This requires that they work together to ensure that the associated technology is inexpensive and easily replicable in rural areas, notably in promoting labor and local materials.

The effective participation of farmers through a participatory approach and involvement of NGOs alongside research institutions would be a prerequisite for the successful extension of the practice of supplemental irrigation. This is especially important for appropriation of technologies by farmers.

Indeed, supplemental irrigation is compatible with the practice of zaï and half-moons; this means that local knowledge and research can greatly improve agricultural production. For Burkina Faso, there are efforts in this direction and more and more farmers are interested in collaboration with NGOs and research institutions.

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